

# (12) UK Patent Application (19) GB (11) 2 097 497 A

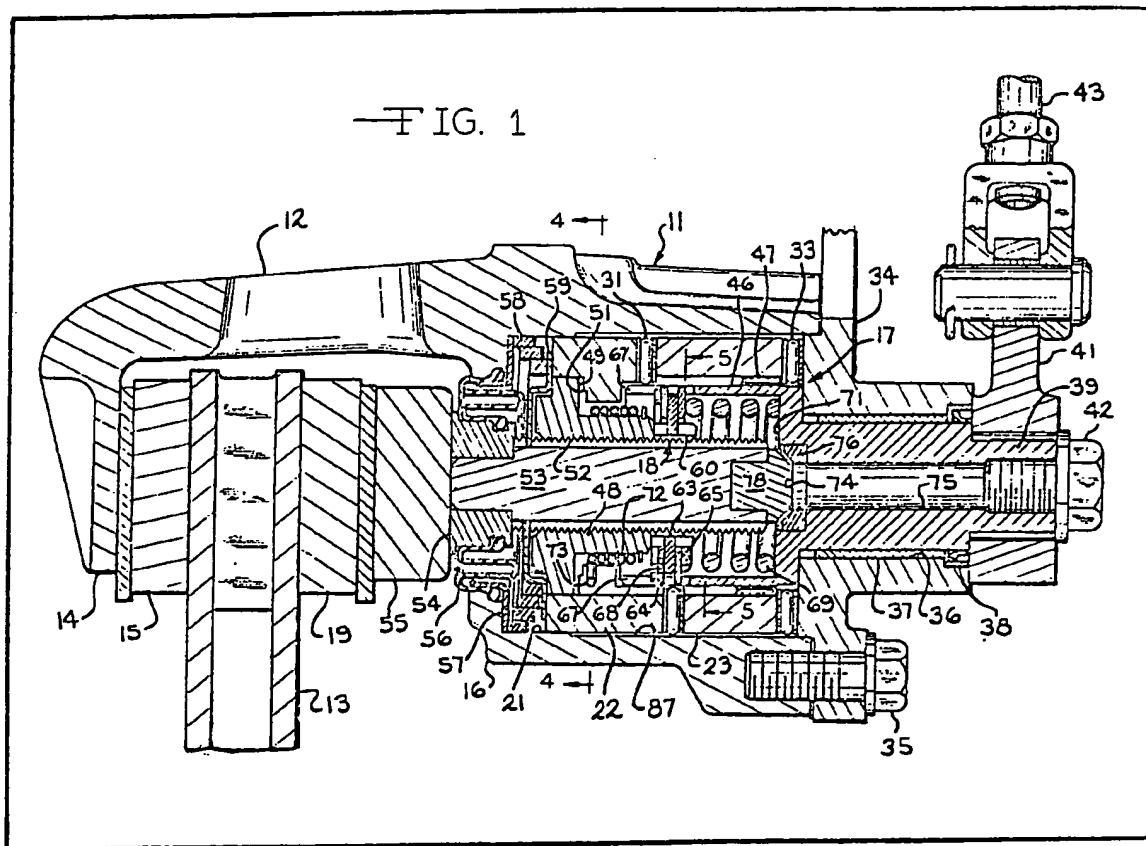
- (21) Application No 8213406  
 (22) Date of filing 14 Feb 1980  
 Date lodged 10 May 1982  
 (30) Priority data  
 (31) 11968  
 (32) 14 Feb 1979  
 (33) United States of America  
 (US)  
 (43) Application published  
 3 Nov 1982  
 (51) INT CL<sup>3</sup>  
 F16D 65/56 55/22 65/46  
 (52) Domestic classification  
 F2E 2N1D16 2N1D2C  
 2N1D3A 2N1D6C5 2N1E5  
 2N1K1 2N1K2 EB LX  
 F2K 3A2C1 3B2E 3B3C  
 3B4B  
 (56) Documents cited  
 GB 1537507  
 GB 1494221  
 GB 1480741  
 GB 1368125  
 GB 1267709  
 GB A 2045877  
 (58) Field of search  
 F2E

- (60) Derived from Application  
 No. 8004924 under section  
 15(4) of the Patents Act  
 1977.  
 (71) Applicant  
 Kelsey-Hayes Company  
 38481 Huron River Drive  
 Romulus  
 Michigan 48174  
 United States of America  
 (72) Inventor  
 Leonard T. Tribe  
 (74) Agents  
 Abel and Imray,  
 Northumberland House,  
 303—306 High Holborn,  
 London,  
 WC1V 7HL

(54) Improvements in and relating to  
 actuators especially for brakes

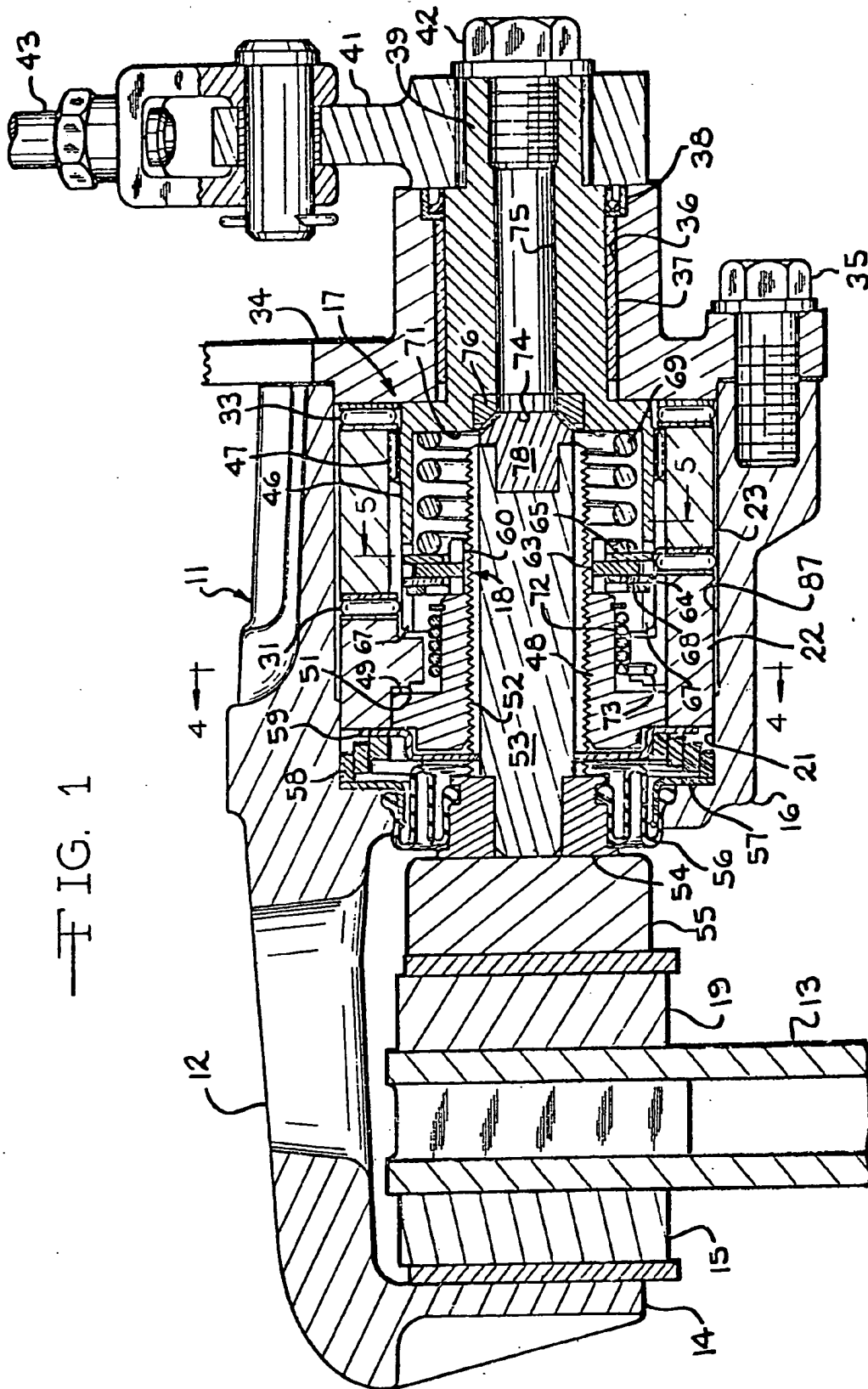
(57) In a sliding caliper disc brake  
 actuator, an actuating shaft 39 is  
 rotatable to rotate a helical cam

element 23 that in turn axially  
 displaces a non-rotatable cam  
 element 22. The element 22 and 23  
 are located in a bore 21 in a caliper  
 leg 16 with an automatic adjusting  
 mechanism 18. A helical return spring  
 58 acts via a washer 59 to bias the  
 cam elements together and a push rod  
 53 of mechanism 18, is held against  
 rotation by a washer 59. A nut 48 of  
 mechanism 18 is threaded onto the  
 rod 53 and engaged by cam element  
 22 to transmit axial force to the push  
 rod 53 and relative extension of the  
 push rod from the elements 22, 23 is  
 accomplished by a one-way spring  
 brake 72 acting on the nut 48 and a  
 disc clutch drive 63 to 69 between the  
 cam element 23 and the nut 48. Lost  
 motion is provided at the clutch drive  
 or the spring brake to prevent rotation  
 of the nut 48 on the rod 53 during  
 normal clearance, and rotation of the  
 nut on the push-rod occurs when  
 excessive clearance occurs.



GB 2 097 497 A

FIG. 1



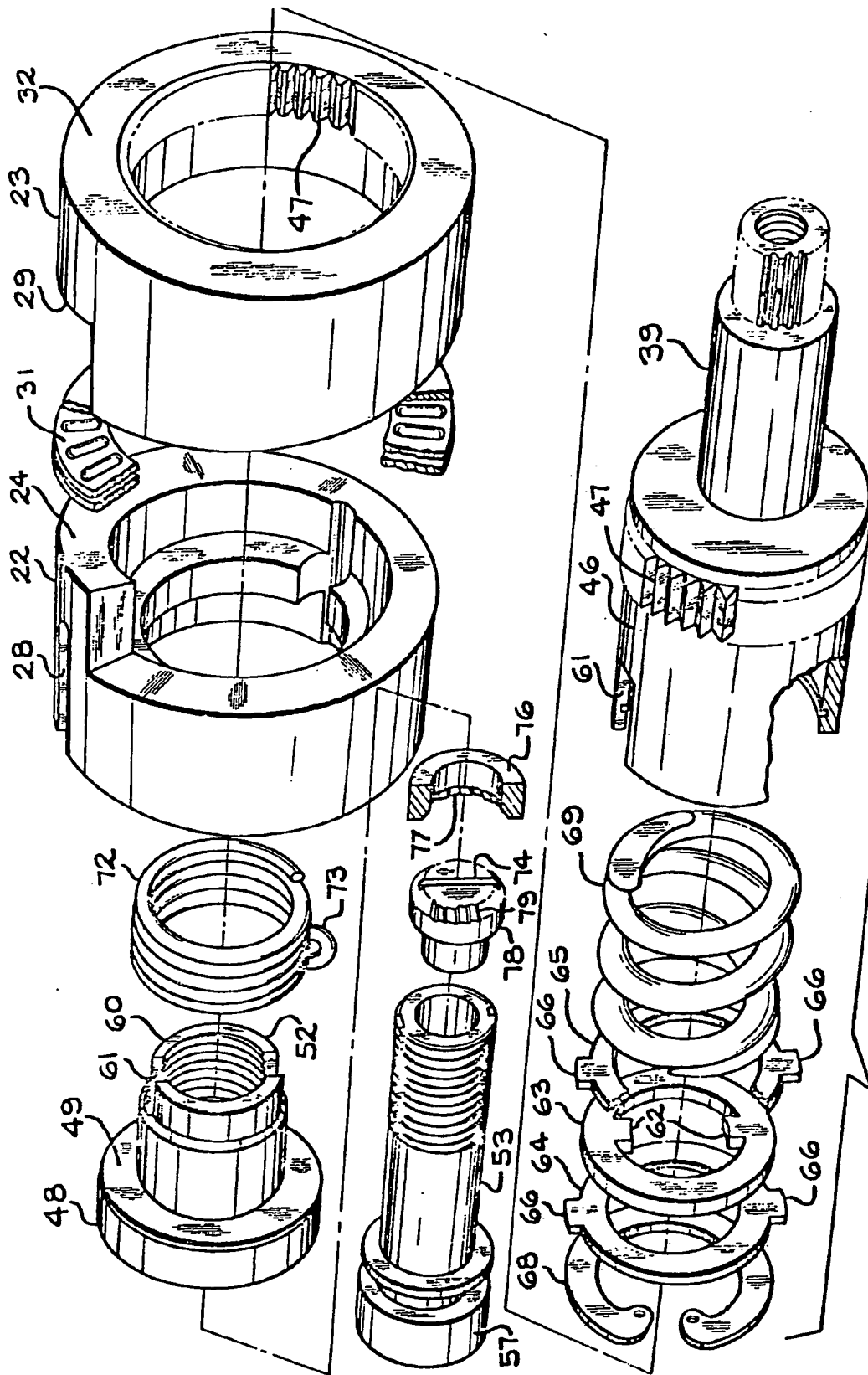


FIG. 2

FIG. 3

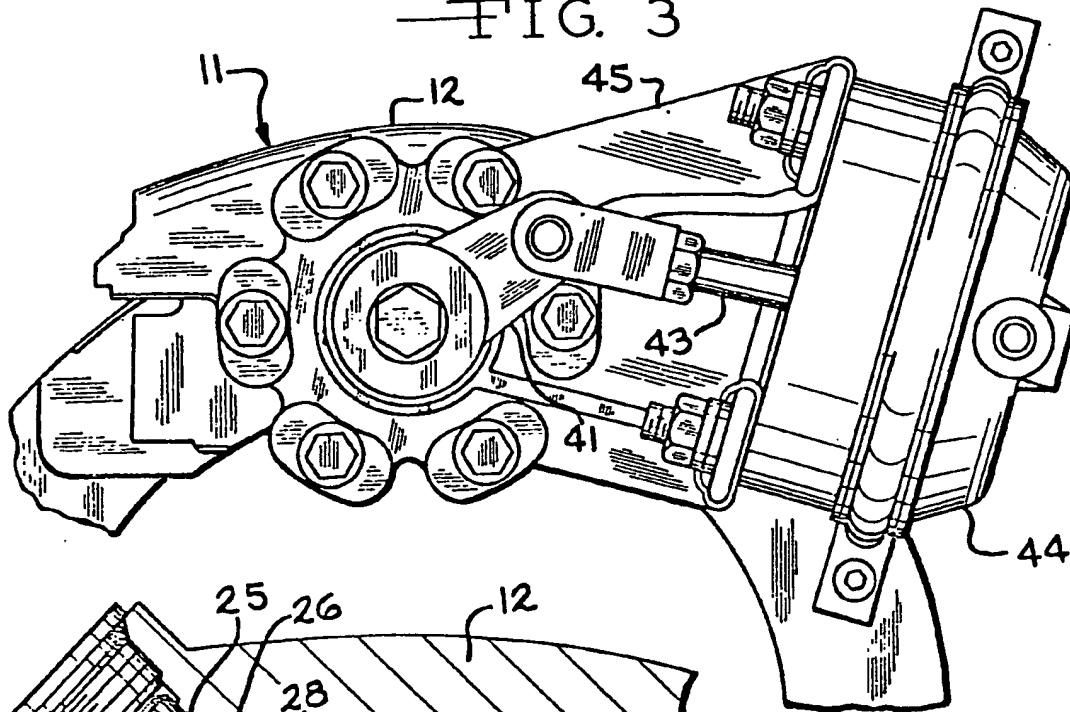


FIG. 4

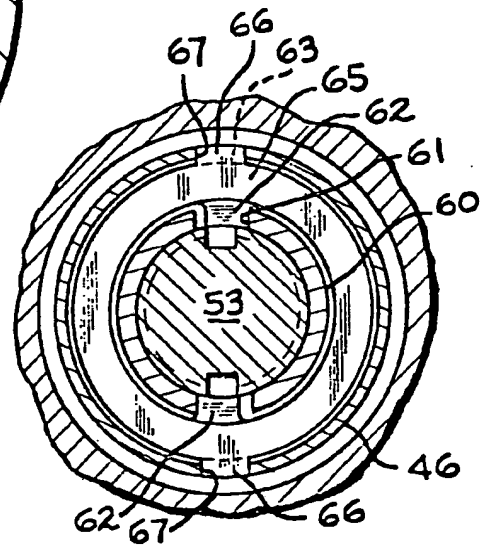
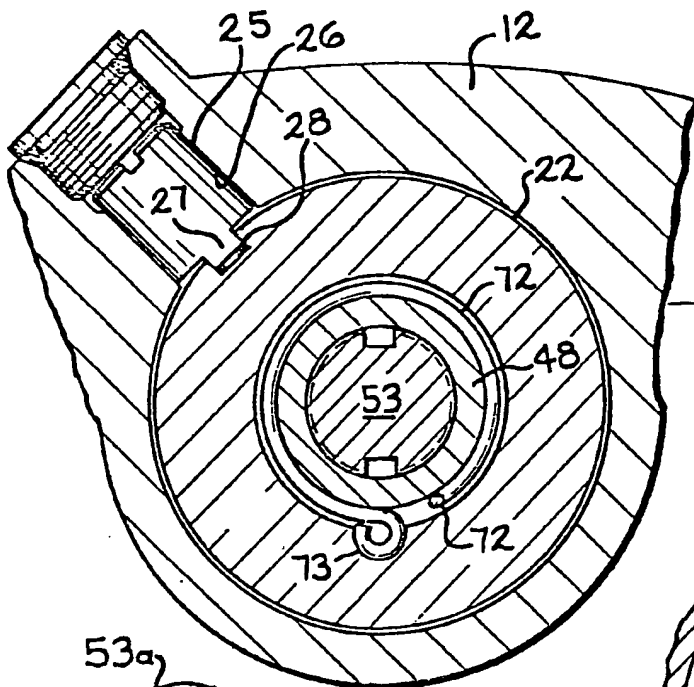


FIG. 5

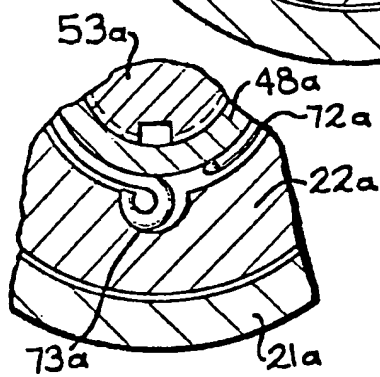


FIG. 6

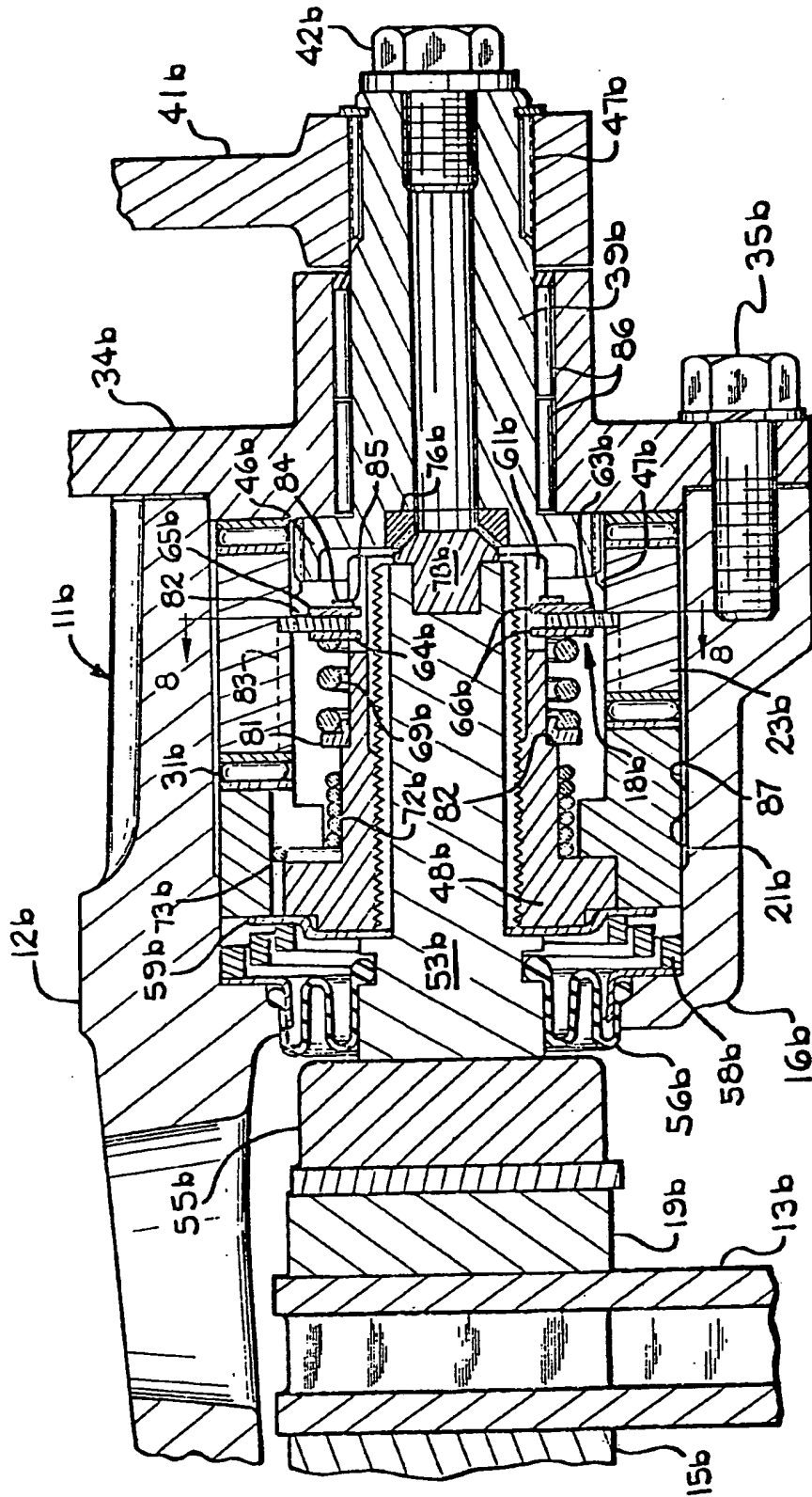
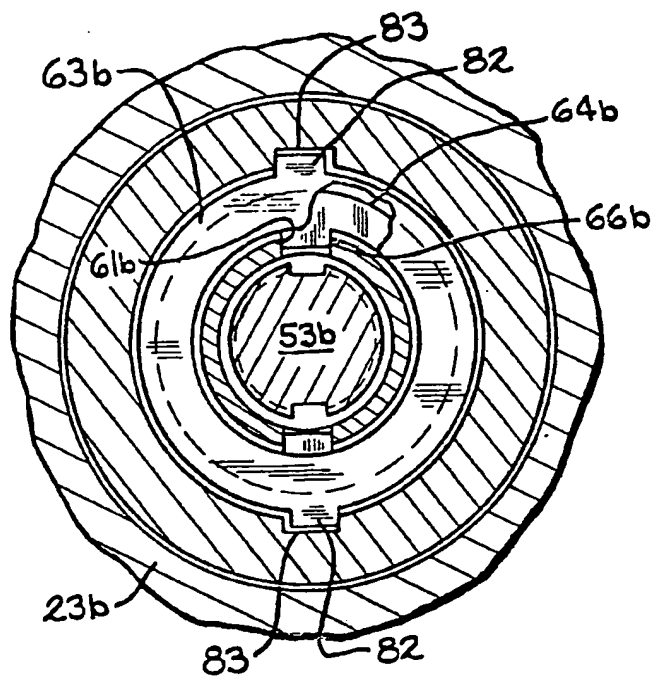


FIG. 7



—FIG. 8

**SPECIFICATION**  
**Improvements in and relating to actuators**  
**especially for brakes**

The invention relates to an automatic  
 5 adjustment mechanism for a push-rod actuator,  
 especially for a caliper brake, and especially to a  
 caliper brake having an automatic adjustment  
 mechanism in which the brake clearance can be  
 10 precisely increased or decreased manually from  
 outside the brake while the brake is in its  
 operative position on the vehicle on which it is  
 installed.

A number of designs of rotary cam actuator for  
 caliper brakes have previously been proposed, but  
 15 they suffer from a number of adjustment and  
 maintenance difficulties. In the type of actuator  
 with which the present invention is concerned,  
 the brake pad is squeezed against the rotating  
 disc by a threaded post that in turn is engaged by  
 20 a threaded nut that in turn is driven axially by a  
 rotary cam mechanism. In some of these  
 previously proposed mechanisms, the rotary drive  
 structure for the cam is in sliding contact with  
 portions of the nut and, when corrosion occurs or  
 25 dirt enters the structure, the nut may bind to the  
 rotary drive structure so that the rotary drive  
 structure may rotate the nut in both directions on  
 the threaded post thereby preventing proper  
 adjustment of the brake clearance.

30 Other such mechanisms are so arranged that  
 the post is held stationary and it is only the nut  
 that is adjusted, both manually and automatically,  
 to control brake clearance. In some of these  
 structures, the nut cannot be backed off manually  
 35 to increase the brake clearance without removing  
 the brake from the vehicle in which it is installed.

In some other brake mechanisms, it is possible  
 to retract the post to such an extent that the nut  
 becomes so tightly jammed onto the threads of  
 40 the post that the automatic adjusting portion of the  
 brake slips without adjusting the brake. When such  
 brakes are actuated by air pressure, or some other  
 mechanism with which the movement of the  
 actuating lever is not proportional to the  
 45 movement of the brake control by the driver, the  
 lack of adjustment is not sensed by the driver, and  
 uneven brake application can occur.

In still other such brakes, hard-to-seal  
 passages lead through the housing to the  
 50 adjustment mechanism and/or the threaded nut  
 extends outside the housing where corrosion can  
 freeze the nut. If a protective cover, which is  
 usually of the rubber diaphragm type, becomes  
 damaged or does not seal for any reason.

55 An object of the present invention is the  
 provision of an automatic adjuster which cannot  
 be manually adjusted to a point at which the  
 automatic adjusting mechanism becomes  
 inoperative.

60 Another object of the present invention is the  
 provision of an automatic adjuster wherein the  
 threaded brake-actuating post is engaged by a  
 threaded nut which in turn is moved axially by a  
 rotatable cam mechanism and in which the

65 threaded nut is held against being rotated in a  
 direction which would tend to retract the  
 threaded post.

A still further object of the present invention is  
 the provision of a caliper brake in which the rotary  
 70 drive mechanism for the rotary cam is not in  
 sliding engagement with the threaded nut.

The invention provides an actuator comprising  
 an externally threaded longitudinally extending  
 actuating rod, a nut threaded on the rod,  
 75 actuating means for advancing the nut  
 longitudinally forwards against a return spring,  
 means for urging the nut rotationally with a  
 predetermined maximum torque in the sense to  
 advance the rod through the nut when the nut is  
 80 advanced, and a washer nonrotatably engaged  
 with the rod and so held by the return spring as to  
 impart to it a resistance to rotation greater than  
 the said predetermined torque.

The invention also provides a brake  
 85 mechanism, especially a disc brake mechanism,  
 which includes a brake and an actuator for the  
 brake, wherein the actuator is an actuator  
 according to the invention.

The invention further provides a brake  
 90 mechanism having an actuator with relatively  
 rotatable components arranged to cause  
 actuation of the brake upon such relative rotation,  
 a pair of co-operating threaded elements for  
 effecting adjustment of the inactive position of  
 95 the brake, an automatic adjusting means for  
 effecting rotation of one of said threaded  
 elements relative to the other for adjusting the  
 inactive position of the brake in response to wear  
 of the brake pads, the automatic adjusting means  
 100 comprising a clutch forming an operative  
 connection between one of the actuator  
 components and one of the threaded elements for  
 effecting rotation of the said one threaded  
 element upon rotation of the said one actuator  
 105 component. In a first direction, the operative  
 connection including a lost motion connection for  
 permitting relative rotation of the said one  
 actuator component relative to the said one  
 threaded element to establish the normal running  
 110 clearance in the brake, the clutch being arranged  
 to slip and permit rotation of the said one actuator  
 component relative to the said one threaded  
 element when the brake loading exceeds a  
 predetermined value for preventing over-  
 115 adjustment of the brake, and a one-way brake co-  
 operating with the said one threaded element for  
 limiting the return rotation of the said one  
 threaded element upon rotation of the said one  
 actuator component in the opposite direction, the  
 120 said clutch being operative to slip upon such  
 return rotation of the said one actuator  
 component upon the actuation of the said one-  
 way brake.

The invention still further provides a caliper  
 125 brake actuator comprising a housing having inner  
 and outer legs which projects radially inwards on  
 respective inner and outer sides of a rotor cavity,  
 the inner leg having a transverse bore extending  
 from its inner end to the rotor cavity, a cover plate

on the inner end of the bore, an actuating shaft extending into transverse bore through the cover plate and journalled in the cover plate, a rotary cam member in the bore, a non-rotatable cam member operatively abutting the rotary cam member to produce transverse movement upon rotation of the rotary cam member, a brake-applying post projecting out of the bore into the rotor cavity, the cam members being arranged to force the brake-applying post out of the bore upon rotation of the rotary cam member, the nonrotatable cam member being slidably supported by the side walls of the bore, the post being supported from the nonrotatable cam member, and the rotatable cam member being supported by the actuating shaft out of frictional engagement with the side walls of the bore.

Two forms of caliper brake constructed in accordance with the invention will now be described by way of example with reference to the accompanying drawings, in which:

Figure 1 is a longitudinal cross sectional view through a first form of disc brake;

Figure 2 is an exploded view of parts of the automatic adjusting mechanism of the brake shown in Figure 1;

Figure 3 is an elevation of the brake shown in Figure 1;

Figure 4 is a cross sectional view taken approximately on the line 4—4 of Figure 1;

Figure 5 is fragmentary cross sectional view taken approximately on the line 5—5 of Figure 1, showing one form of lost motion connection in the automatic adjusting mechanism;

Figure 6 is a fragmentary view of another form of lost motion connection;

Figure 7 is a fragmentary longitudinal sectional view similar to Figure 1, but showing the second form of brake; and

Figure 8 is a fragmentary cross sectional view taken approximately on the line 8—8 of Figure 7.

Referring to Figures 1 to 5 of the accompanying drawings, the first form of cam actuated disc brake, which is indicated generally by the reference numeral 11, includes a caliper 12 that is supported adjacent to a rotor 13. The caliper 12 is supported so that it may slide in a direction parallel to the axis of the rotor 13 but is held against rotation.

As is common in sliding caliper type disc brakes, the caliper 12 has a first leg 14, adjacent to one of the braking surfaces of the rotor 13, to which a brake pad 15 is fixed in any suitable manner. A second leg 16 of the caliper 12 is disposed adjacent to the opposite braking surface of the rotor. An actuating mechanism, indicated generally by the reference numeral 17, an automatic adjusting mechanism, indicated generally by the reference numeral 18, are associated with the second leg 16 of the caliper. These mechanisms act upon a brake pad 19 which is disposed in opposition to the brake pad 15 and which cooperates with the adjacent braking surface of the rotor 13.

The second caliper leg 16 is formed with an

elongate bore 21 in which a nonrotatable cam element 22 and a rotary cam element 23 are supported. The nonrotatable cam element 22 has a helical cam surface 24 formed on its rearward face, that is to say, the face furthest from the disc 13 (see Figure 2). The cam element 22 is supported within the bore 21 for axial movement but is held against rotation. This is accomplished by means of a staking pin 25 (see Figures 2 and 4) that is held in place at the base of a tapped opening 26 in the caliper leg 16. The pin 25 has a key portion 27 that extends into an elongate groove 28 formed in the cam element 22.

The rotary cam element 23 also has a helical cam surface 29 (see Figure 2) which is complementary in shape to the cam surface 24 and is juxtaposed to it. A suitable antifriction bearing 31 is interposed between the cam surfaces 29 and 24 so as to limit the amount of friction between these surfaces.

The face 32 of the rotary cam element 23 opposite its cam surface 29 is engaged with an antifriction bearing 33 which, in turn, bears against a closure plug 34 that is fixed across the open end of the bore 21 by means of machine screws 35.

The closure plug 34 is formed with an axially extending bore 36 in which a sleeve bearing 37 and a seal 38 are supported. An actuating shaft 39 extends through the bore 36 and is rotatably supported by the bearing 37. An actuating lever 41 is non-rotatably fixed to the actuating shaft 39 by a spline and a machine screw 42. The actuating lever 41 is pivotably connected to a rod 43 of an actuating air motor 44 (see Figure 3) that is fixed by means of a bracket 45 relative to the caliper assembly 12. The actuating motor 44 rotates the actuating shaft 39 via the lever 41.

The actuating shaft 39 has a generally hollow cylindrical section 46 that extends into the bore 21 radially inside the rotary cam element 23. A spline connection 47 connected the actuator shaft portion 46 with the rotary cam element 23 to effect simultaneous rotation of these components.

The automatic adjusting mechanism 18 includes an annular nut 48 having a shoulder 49 for abutment with a corresponding shoulder 51 formed on the nonrotatable cam element 22. Internal threads 52 of the nut 48 are engaged with threads of an axially extending male threaded rod 53. The male threaded rod 53 has a reduced diameter end portion carrying a collar 54 that is engaged with a load distributor 55 which bears against the brake pad 19. A suitable boot or dust seal 56 encircles the collar 54 and is held in place relative to the open end of the caliper bore 21 by means of a retaining ring 57 that is positioned against the inner end of the bore 21 to seal the internal portions of the brake actuating mechanism 17 and the automatic adjusting mechanism 18. A helically wound compression spring 58 is positioned between the seal retaining ring 57 and a hat-shaped combination bearing plate and dirt seal 59, the radially outer portion of

which bears against the cam 22 to effect retraction of the brake.

The nut 48 has an axially extending projection 60 that is slotted as at 61, to receive one or more tangs 62 of an annular clutch plate 63. There is a predetermined clearance of approximately five degrees of rotation between the tangs 62 and the sides of the slots 61 which clearance establishes the normal running clearance of the brake 11.

The clutch plate 63 is received between a pair of annular clutch plates 64 and 65 which, in turn, have a tangted connection to the hollow cylindrical section 46 of the actuating shaft 39. The tangted connection comprises tangs 66 formed on the clutch plates 64 and 65 (see Figure 5) and slots 67 formed in the hollow cylindrical section 46. A snap ring 68 bears against the clutch plate 64 and is fixed within a groove in the hollow cylindrical section 46. A large compression spring 69 bears against the clutch plate 65 and against a shoulder 71 formed at the base of the hollow cylindrical portion 46. The spring 69 provides the pressure between the clutch plates 64 and 65 and the clutch plate 63 and determines the torque at which this clutch will slip.

Rotation of the actuating shaft 39 in the direction to actuate the brake will produce rotation of the nut 48 in the direction to advance the rod 53 through the nut except during the five degrees of lost motion clearance between the tangs 62 of the clutch plate 63 and the sides of the slots 61 in the nut. In order that this five degrees of lost motion can occur at the start of each actuation, means are provided for preventing the nut from rotating backwards when the actuating shaft 39 is rotated backwards to release the brake. In the brake shown in Figures 1 to 5 of the accompanying drawings, this is accomplished by a spring brake 72 that encircles the nut 48 and has a projection 73 fixed relative to the nonrotating cam element 22. The spring brake 72 acts as a one way brake so that the nut 48 can rotate in the forward direction, but not in the reverse direction. During reverse rotation of the actuating shaft 39, the reactive forces produced by the brake lining of the rotor 13 initially hold the shoulder 49 of the nut 48 in engagement with the shoulder 51 of the nonrotatable cam element 22, preventing rotation of the nut. As the brake is released, the nut 48 moves out of engagement with the shoulder 51 and rotation of the nut 48 is prevented by the spring brake 72. During this motion, the shoulder 49 of the nut moves away from the shoulder 51 while the forward face of the nut 48 moves into engagement with the hat-shaped washer 59 which thereafter positively retracts the nut and the push rod 53 to leave a running clearance in the brake. In the brake shown in Figures 1 to 5, a clearance of 0.015 inch (0.38 mm) is left between the shoulders 49 and 51. Throughout this deactivating movement of the shaft 39, the clutch discs 64 and 65 are rotated clockwise, as seen in Figure 5, to move the tangs 62 of the clutch disc 63 into engagement with the trailing side edges of the

slots 61 in the nut 48. During the next activation, therefore, the tangs 62 must move the full five degrees counterclockwise, as seen in Figure 5, before they engage the leading side edges of the slots 61. The clearance between the shoulders 49 and 51 prevents binding between the nut 48 and the nonrotatable cam element 22 during automatic adjustment.

One of the problems which occur with prior art slack adjuster constructions is that they do not allow access to the pushrod (corresponding to the threaded rod 53) after the brake is installed. In the construction here described, the nonrotating cam element 22 is positioned adjacent to the nut 48, and the rotary cam element 23 is positioned behind the nonrotating cam element. With this construction, the rotary cam element 23 can be driven by the axially extending shaft 39 projecting through the outer wall of the actuator away from the brake rotor and the actuating and adjusting mechanism is positioned between the closure plug 34 at the open end of the bore 21 and the inner seal structure of the brake. This seal structure includes the hat-shaped washer 59. The outer periphery of the washer 59 is always held in sliding engagement with the nonrotating cam element 22 while the centre portion of the washer 59 makes a sliding nonrotational close fit with the actuating rod 53. The washer 59, therefore, provides a metal sliding seal which protects the inner workings of the brake while also providing a friction clutch for preventing rotation of the push rod 53 by the nut 48. In some previously proposed designs, it was necessary to prevent rotation of the push rod 53 by means of a sliding structure located in the space adjacent to the rotor 13 where the sliding structure was bathed in water and dirt.

The running clearance of the brake shown in Figures 1 to 5 of the drawings can be adjusted manually while the brake is in position over the rotor 13 by rotating the push rod 53 relative to the nut 48. This is accomplished by a torque transmitting means, which in the present instance is a screwdriver slot 74 fixed in the end of the actuating rod 53. The screwdriver slot 74 is accessible through a passageway 75 which extends along the centre of the actuating shaft 39 and the outer end of which is closed off by the machine screw 42 that retains the actuating lever 41.

In some previously proposed actuating mechanisms it is possible for a mechanic to unknowingly back off the actuating rod 53 to such an extent that it is jammed up against the actuating shaft 39. If this is done, the actuating rod 53 and the shaft 39 may bind so tightly that the clutch plates 63, 64 and 65 slip without adjusting the nut 48. This, of course, will defeat the self adjusting feature of the brake.

In the brake shown in Figures 1 to 5, jamming is prevented by providing teeth on the abutting surfaces of the rod 53 and the surface which it abuts which prevents the rod from being rotated into a jammed condition. As shown in the

drawings, it is accomplished by providing an annular ring 76 which surrounds the passageway 75 and which has square teeth 77 on its abutment surface. The end of the rod 53 has an abutment 78 pressed into its end, and the abutment surface of the abutment 78 is provided with ratchet teeth 79, the flat sides of which will engage the flat sides of the square teeth 77 to limit the retraction of the rod 53 toward the annular ring 76. The ratchet teeth 79, however, permit the rod 53 to be easily rotated in an advancing direction away from the annular ring 76 by the automatic adjusting mechanism.

Relining of the brakes is simple. The machine screw 42 is removed from the passageway 75, and a screwdriver is inserted into the slot 74 to turn the rod 53 counterclockwise as seen in Figures 4 and 5. This backs the rod 53 through the nut 48 to provide clearance between the pads 15 and 19 and the rotor 13. New pads 15 and 19 are inserted, the brake assembly is put back on the vehicle and the rod 53 is rotated clockwise until the brake pads are brought adjacent to the rotor 13. During rotation of the rod 53 by the screwdriver, its motion is opposed by sliding friction between the hat-shaped washer 59 and the nonrotatable cam member 22 under the clamping action of the spring 58. This frictional engagement will hold the rod 53 in its adjusted position, and the clutch plates 63, 64 and 65 are operative thereafter to rotate the nut 48 relative to the rod 53. The machine screw 42 is reinstalled to seal off the mechanism from water and dirt.

The drawings illustrate the brake 11 in a released position. To actuate the brake, the piston rod 43 is extended so as to rotate the lever 41 and shaft 39 in a counterclockwise direction as seen in Figures 3 to 5. This effects rotation of the rotary cam element 23 relative to the nonrotatable cam element 22 to exert an axial force on the nonrotatable cam element 22. The nonrotatable cam element 22 is thus shifted to the left, as seen in Figure 1, along with the nut 48 and the threaded rod 53, compressing the spring 58. The brake pad 19 is thus brought into engagement with the associated braking surface of the rotor 13 producing a reactive force which slides the caliper 12 to the right, as seen in Figure 1. The brake pad 15 is thus brought into engagement with the opposite braking surface of the rotor 13.

As the cam element 23 is rotated, it rotates the clutch plates 64 and 65 which in turn rotate the clutch plate 63. Unless sufficient lining wear has taken place for the brake to require adjustment, the tangs 62 of the clutch plate 63 will merely traverse the slots 61 in the nut 48 and no rotation of the nut will result.

If, however, sufficient lining wear has taken place to necessitate adjustment of the brake, the clutch plate 63 will traverse the entire width of the slots 61 and will then rotate the nut 48 in the adjusting direction, which is the direction of rotation permitted by slippage of the one-way spring brake 72. The rotation of the nut 48 will

advance the threaded rod 53 to take up the clearance in the brake, the rod being held against rotation by the hat-shaped washer 59 and the compression spring 58. Once the brake pads 15 and 19 engage the rotor braking surface with a predetermined pressure, determined by the spring 69 which provides the contact pressure between the clutch plates 63 to 65, continued rotation of the cam 23 in the actuating direction will cause the clutch plates 64 and 65 to slip relative to the clutch plate 63 without rotating the nut 48 any further, so that over-adjustment of the brake is prevented.

The brake is released by rotating the cam element 23 in the opposite direction. The cam surfaces 29 and 24 then permit the spring 58 to return the nonrotatable cam element 22 towards its inactive position along with the nut 48 and the threaded rod 53. Any tendency for the nut 48 to rotate in the anti-adjusting direction will, however, be prevented by the one-way spring brake 72. Thus, the nut 48 will be maintained in its newly adjusted position relative to the threaded rod 53.

The brake shown in Figure 6 corresponds generally to the brake shown in Figure 1 to 5, except in the arrangement of the lost motion connection. Those portions of the brake shown in Figure 6 which corresponds to similar portions of the embodiment shown in Figures 1 to 5 are designated by the same reference numeral but with a letter *a* suffixed.

Figure 6 shows a type of lost motion connection which can be used instead of a clearance between the tangs 62 and the slots 61. In the brake shown in Figure 6, the tangs 62 substantially fill the slots 61 and the five degrees of lost motion is provided by a clearance between the projection 73 of the spring brake 72 and its retaining surfaces in the nonrotatable cam element 22.

The operation of the brake shown in Figure 6 is similar to that of the brake shown in Figures 1 to 5 except for the location at which the lost motion takes place.

The second form of brake shown in Figures 7 and 8 of the accompanying drawings corresponds generally to the first form, differing principally in that the clamping spring 69*b* for the clutch is positioned on the inner side of the clutch plates instead of the outer side. Those portions of the brake shown in Figures 7 and 8 which are similar to corresponding portions of the brake shown in Figures 1 to 5 are designated by the same reference numeral but with the letter *b* suffixed.

In the brake shown in Figures 7 and 8, the nut 48*b* is elongate and the clutch spring 69*b* is positioned between the inner clutch plate 64*b* and an annular spring retainer 81 that in turn is positioned against an outwardly facing shoulder 82 on the nut 48*b*. In order that the spring 69*b* should be positioned between two surfaces which do not rotate relative to each other, the clutch plates 64*b* and 65*b* are slidably coupled to the nut 48*b* rather than to the actuating shaft 39*b*.

The clutch plates 64*b* and 65*b* carry on their inner peripheries tangs 66*b* that are received in the slot 61*b* of the nut 48*b*, while the control clutch plate 63*b* is supplied with tangs 82 on its outer periphery that are received in slots 83 in the inner periphery of the rotary cam element 23*b*. The actuating shaft 39*b* also carries teeth that engage the splined configuration 47*b* of the cam element 23*b*. This construction has the advantage that it permits the actuating shaft 39*b* to have a much shorter annular driving portion 46*b* than was required in the first form of brake described.

The clutch discs 64*b* and 65*b* are held onto the nut 48*b* by a snap ring 84 which is positioned behind the clutch plate 65*b*, and which is received in a groove 85 in the outer end of the nut 48*b*. Also in the brake shown in Figures 7 and 8, no collar 54 is used to engage the load distributor 55*b*, and the rod 53*b* has its front end enlarged to act as the retainer for the dust seal 56*b*. Also, the sleeve bearing 37 of the first form of brake is replaced by two roller bearings 86 which, like the sleeve bearing 37 in the first form of brake, not only support and centre the drive shaft 39*b*, but also hold the cam element 23*b* out of sliding engagement with the side walls of the bore 21*b* by reason of the tightly fitting spline connection 47*b*. Five degrees of lost motion are provided between the tangs 82 of the clutch plate 63*b* and the side walls of the grooves 83 in the rotary cam element 23*b*.

In all of the brakes described above, the side wall of the elongate bore 21 is enlarged slightly as is shown at 87 in Figures 1 and 7 over the rotary cam element 23 of the cam actuator, so that the rotary cam element is held out of sliding engagement with the housing by the actuating shaft 39. The spline connection 47 between the rotary cam element 23 and the annular extension 46 of the actuating member 39 is a tight sliding fit so that the rotary cam element 23 is held away from the side walls 87 of the bore 21. On the other hand, the axially driven nonrotatable cam bears against the side walls of the bore 21, and it in turn journals the nut 48 to centre the threaded rod 53 relative to the actuating structure. The frictional drive mechanisms of the brake are sealed off between the hat-shaped washer 59 and the rotary seal 38 which surrounds the shaft 39, so that the torque developed by the frictional devices does not change appreciably during use. The brake can nevertheless be manually adjusted while the brake is in position on a vehicle through a passageway through the actuating shaft which is located in the outer end of the housing.

#### Claims

1. An actuator comprising an externally threaded longitudinally extending actuating rod, a nut threaded on the rod, actuating means for advancing the nut longitudinally forwards against a return spring, means for urging the nut rotationally with a predetermined maximum torque in the sense to advance the rod through the nut when the nut is advanced, and a washer

nonrotatably engaged with the rod and so held by the return spring as to impart to it a resistance to rotation greater than the said predetermined torque.

2. An actuator as claimed in claim 1, including torque transmitting means on the back end of the rod to which means a torque can be applied manually and which is capable of transmitting a torque sufficient to overcome the said resistance to motion.

3. An actuator as claimed in claim 1 or claim 2, wherein the return spring is a compression spring.

4. An actuator as claimed in any one of claims 1 to 3, wherein the washer is held between the return spring and the nut.

5. An actuator as claimed in any one of claims 1 to 4, wherein the actuating means is a nonrotatable longitudinally movable actuating member.

6. An actuator as claimed in claim 5, wherein the actuating member is a hollow cylinder encircling the rod.

7. An actuator as claimed in claim 6, wherein a flange is provided on the exterior of the nut, a flange is provided on the interior of the actuating member, and in operation the flange on the actuating member engages the flange on the nut to advance the nut longitudinally.

8. An actuator as claimed in claim 6 or claim 7, wherein the washer is held between the spring and the actuating member.

9. An actuator as claimed in claim 8 when dependent upon claim 7, wherein the axial thickness of the flange on the nut is less than the axial length of the actuating member between its flange and the washer.

10. An actuator as claimed in any one of claims 6 to 9, wherein the rear end face of the actuating member comprises a helical cam surface that engages a complementary cam surface on the front end of a rotary annular cam member the rear end surface of which engages a reaction member.

11. An actuator as claimed in claim 10, wherein the reaction member is part of a housing for the actuator.

12. An actuator as claimed in claim 10 or claim 11, wherein the front and rear faces of the rotary cam member engage their adjacent members through roller bearings.

13. An actuator as claimed in any one of claims 10 to 12, wherein the arrangement is such that the torque for urging the nut rotationally derives from the rotary cam member.

14. An actuator as claimed in any one of claims 10 to 13, wherein in use the rotary cam member is rotated by a rotatable actuating shaft extending axially backwards from the rotary cam member.

15. An actuator as claimed in claim 14, wherein the actuating shaft is journaled in a cap portion of a housing for the actuator, and serves to locate the rotary cam member against transverse movement and so to maintain it out of contact with the housing.

16. An actuator as claimed in claim 14 or claim 15, wherein the rear end of the rod is accessible

through an axial passage along the actuating shaft.

17. An actuator as claimed in any one of claims 14 to 16, wherein retraction of the rod is limited by the abutment of surfaces on the rod and on the actuating shaft, and wherein each of those surfaces is provided with teeth, the arrangement being such that retraction of the rod is limited by abutment of surfaces of the teeth, which surfaces extend transversely to the local direction of relative movement of the teeth at every point of contact.

18. An actuator as claimed in claim 17, wherein the teeth are in the form of radially extending ridges.

19. An actuator as claimed in claim 17 or claim 18, wherein the teeth on at least one abutment surface are triangular in cross-section parallel to the local direction of relative movement.

20. An actuator as claimed in claim 19, wherein the teeth on the other abutment surface are rectangular in cross-section parallel to the local direction of relative movement.

21. An actuator as claimed in any one of claims 1 to 20, wherein the means for urging the nut rotationally is arranged to act only after the actuating means has advanced by a predetermined amount.

22. An actuator as claimed in claim 21, wherein the means for urging the nut rotationally comprises a rotatable annular member with internal tangs that engage longitudinal grooves in the nut, the grooves being wider circumferentially than the tangs by a predetermined angle subtended the axis.

23. An actuator as claimed in claim 21 or claim 22, wherein the nut is provided with a one-way brake to prevent it from rotating in the same sense to retract the rod.

24. An actuator as claimed in any one of claims 1 to 20, wherein the means for urging the nut rotationally tends to rotate the nut in the reverse sense when the actuating means is withdrawn, and the nut is provided with a one-way brake which is arranged to permit the nut to rotate in the reverse sense through only at most a predetermined angle.

25. An actuator as claimed in claim 22 or claim 24, wherein the said predetermined angle is approximately 5 degrees of arc.

26. An actuator as claimed in any one of claims 1 to 25, wherein the maximum torque which, in operation, is exerted by the means for urging the nut rotationally is determined by a spring-loaded clutch through which the torque is transmitted to the nut.

27. A brake mechanism which includes a brake and an actuator for the brake, wherein the actuator is an actuator as claimed in any one of claims 1 to 26.

28. A brake as claimed in claim 27, which is a disc brake.

29. A disc brake as claimed in claim 27, wherein in use the rod acts on one brake pad, and

the reaction forces act on a caliper which acts on the other brake pad.

30. A brake mechanism having an actuator with relatively rotatable components arranged to cause actuation of the brake upon such relative rotation, a pair of co-operating threaded elements for effecting adjustment of the inactive position of the brake, an automatic adjusting means for effecting rotation of one of said threaded elements relative to the other for adjusting the inactive position of the brake in response to wear of the brake pads, the automatic adjusting means comprising a clutch forming an operative connection between one of the actuator components and one of the threaded elements for effecting rotation of the said one threaded elements upon rotation of the said one actuator component in a first direction, the operative connection including a lost motion connection for permitting relative rotation of the said one actuator component relative to the said one threaded element to establish the normal running clearance in the brake, the clutch being arranged to slip and permit rotation of the said one actuator component relative to the said one threaded element when the brake loading exceeds a predetermined value for preventing overadjustment of the brake, and a one-way brake co-operating with the said one threaded element for limiting the return rotation of the said one threaded element upon rotation of the said one actuator component in the opposite direction, the said clutch being operative to slip upon such return relative rotation of the said one actuator component upon the actuation of the said one-way brake.

31. A brake mechanism as claimed in claim 30, wherein the one-way brake is arranged to slip at a predetermined loading to permit manual rotation of the said one threaded element.

32. A brake mechanism as claimed in claim 30 or claim 31, wherein the relatively rotatable actuator components comprise a pair of cams having facing helical surfaces, a first one of the cams being supported for rotation and being held against axial movement, the second of the cams being restrained from rotation and being supported for axial movement of the second cam upon rotary movement of the first cam, the clutch connecting the first cam with the one threaded element.

33. A brake mechanism as claimed in claim 32, wherein the one-way brake couples the one threaded element with the second cam for limiting rotation of the one threaded element relative to the second cam in one direction.

34. A brake mechanism as set forth in claim 32 or claim 33, wherein the first and second cams are annular and encircle at least in part the automatic adjusting means.

35. A brake mechanism as claimed in any one of claims 30 to 34, wherein the clutch includes a wound spring element.

36. A brake mechanism as claimed in any one

of claims 30 to 35, wherein the one-way brake comprises a wound spring element.

37. A caliper brake actuator comprising a housing having inner and outer legs which project radially inwards on respective inner and outer sides of a rotor cavity, the inner leg having a transverse bore extending from its inner end to the rotor cavity, a cover plate on the inner end of the bore, an actuating shaft extending into the transverse bore through the cover plate and journaled in the cover plate, a rotary cam member in the bore, a non-rotatable cam member operatively abutting the rotary cam member to produce transverse movement upon rotation of the rotary member, a brake-applying post projecting out of the bore into the rotor cavity, the cam members being arranged to force the brake-applying post out of the bore upon rotation of the rotary cam member, the nonrotatable cam member being slidably supported by the side walls of the bore, the post being supported from the nonrotatable cam member, and the rotatable cam member being supported by the actuating shaft out of frictional engagement with the side walls of the bore.

38. A caliper brake as claimed in claim 37, including a nut threaded onto the post and journaled in the non-rotatable cam member, and a one-way drive mechanism for advancing the nut until resistance is met during rotation of the actuating shaft.

39. A caliper brake as claimed in claim 37 or claim 38, wherein the actuating shaft has a passageway therethrough, the post has a torque-receiving surface opposite the passageway, and a tool can be introduced through the passageway to engage the torque-receiving surface and the post can be threaded through the nut to adjust the brake clearance.

- 40 New Claims or Amendments to Claims filed on 22nd June 1982  
Superseded Claims All

#### New or Amended Claims:—

1. A disc brake, including a rotor, rotatable about an axis, having a friction surface thereon, a friction element for frictionally engaging the friction surface of the rotor, brake-applying means for mechanically urging the friction element into engagement with the rotor friction surface,

- 50 including a push rod with external threads thereon, an annular nut threaded onto the push rod, brake-adjusting means for rotating the annular nut with respect to the push rod to advance the push rod relative to the annular nut in a forward, brake-applying, direction, wherein the brake-adjusting means includes manual adjusting means for manually rotating or counter-rotating the push rod with respect to the annular nut to advance the push rod in the said forward direction relative to said annular nut or retract the push rod in an opposite rearward direction relative to the annular nut, respectively, the manual adjusting means including torque-transmitting means for manually rotating the push rod, access means through which a torque tool may engage the torque-transmitting means to rotate the push rod, and one-way ratchet means for preventing counter-rotation of the push rod beyond a predetermined retraction of the push rod.

2. A disc brake as claimed in claim 1, including cylindrical actuating member that includes a rearwardly-protruding shaft having a hollow axial passageway therethrough communicating with the inside of the cylindrical actuating member and wherein the adjusting means includes an annular ring coaxially fixed within the cylindrical actuating member, said annular ring having internal teeth thereon, an abutment member having teeth and the torque-transmitting means thereon, the abutment member being coaxially fixed to the push rod, the arrangement being such that a torque tool may be inserted through the axial passageway engage the torque-transmitting means and rotate the push rod, the said teeth being so oriented that the push rod may be retracted until the teeth on the abutment member engage the internal teeth on the annular ring.

3. A disc brake as claimed in claim 2, wherein the internal teeth on the annular ring are of triangular cross-section.

4. A disc brake as claimed in claim 2 or claim 3, wherein the teeth on the abutment member are of triangular cross-section.

5. A disc brake as claimed in any one of claims 1 to 4, further comprising a washer rotationally fixed to the push rod and having an outer portion frictionally engaging a non-rotatable member of the brake-applying means to resist rotation of the push rod.